APS

Interfacial Structure of Biological and Biomimetic Films

J. Kent Blasie[1], Venkata Krishnan[1], Jaseung Koo[1], Ruili Zhang[1], Jing Liu[1], Andrey Tronin[1], Joseph Strzalka[2], Ivan Kuzmenko[2], Thomas Gog[2] and Chian Liu[2]

[1]Department of Chemistry, University of Pennsylvania, Philadelphia, PA 19104, USA
[2]Advanced Photon Source, Argonne National Laboratory, Argonne, IL 60439, USA

Interferometric techniques provide substantial advantages in the study of the profile structures of ultrathin organic and bio-organic films at interfaces by specular X-ray and neutron reflectivity. Employing a *multilayer* reference structure provides not only for a unique solution to the phase problem in the derivation of the scattering-length density profile across the interface, but also for a substantial improvement in both the spatial resolution and sensitivity to details in this profile structure. Artificial proteins, engineered to exhibit specific biological or abiological functionality, as well as natural proteins with their evolved functionality, can be vectorially oriented in an extended 2D ensemble at liquid-gas interfaces if they possess sufficient amphiphilic nature, or at solid-liquid interfaces if they possess some chemical specificity for the solid surface. Extending X-ray reflectivity to higher X-ray energies, enhanced by such interferometric techniques, allows investigation of the "steady-state" profile structures of the proteins at the solid-liquid interface as a function of the electrochemical potential across the interface. Undulator-based sources, cylindrically bent reference structures, and fast time-framing detectors further allow "time-resolved" structural studies of such proteins in response to a relevant excitation. Examples illustrating these recent developments address key problems in both materials device applications and membrane biophysics.

Support: Grants (JKB) from the DOE, NSF & NIH